FORM PTO-1390 (REV 10-94) — U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 9320.112USWO

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U S APPLICATION NO (If known, see 37 C F R 1 5): Unknown

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FR99/00849	April 12, 1999	April 10, 1998

TITLE OF INVENTION

CELLULAR RADIOTELEPHONE SIGNAL WITH ADDITIONAL CHANNEL ASSIGNED TO DOWNLINK, CORRESPONDING METHOD, SYSTEM, MOBILE AND BASE STATION

APPLICANT(S) FOR DO/EO/US

ALARD

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND of SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information: Form 1449, 3 cited references; International Search Report; International Preliminary Examination Report; Abstract page

529 Rec'd PCT/PTO 10 OCT 2000

U.S. APPLICATION NO (If known, see 37 C F R 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
Unknown 09/673114	PCT/FR99/00849	9320.112USWO

17. [X] The following fees are submitted:

CALCULATIONS PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)):

Search Report has been prepared by the EPO or JPO **$860.00**

International preliminary examination fee paid to U.S. Patent and Trademark Office (37 CFR 1.492(a)(1)) **$670.00**

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$760.00**

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(3)) paid to USPTO **$970.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **$96.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =				**$860.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				**$0**	
CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE	
Total claims	21	-20 =	18	X **$18.00**	**$18.00**
Independent claims	5	-3 =	2	X **$80.00**	**$160.00**
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ **$260.00**	**$0**
TOTAL OF ABOVE CALCULATIONS =					**$1038.00**
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).					**$0**
SUBTOTAL =					**$1038.00**
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f).				+	**$0**
TOTAL NATIONAL FEE =					**$1038.00**
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property				+	**$0**
TOTAL FEES ENCLOSED =					**$1038.00**
				Amount to be: refunded	**$0**
				charged	**$0**

a. [X] Check(s) in the amount of $1038.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-2725.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO
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SIGNATURE

NAME John J. Gresens

REGISTRATION NUMBER 33,112

S/N Unknown

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	ALARD	Examiner:	Unknown
Serial No.:	Unknown	Group Art Unit:	Unknown
Filed:	October 10, 2000	Docket No.:	9320.112USWO

Title: CELLULAR RADIOTELEPHONE SIGNAL WITH ADDITIONAL CHANNEL ASSIGNED TO DOWNLINK, CORRESPONDING METHOD, SYSTEM, MOBILE AND BASE STATION

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited in the United States Postal Service, as first class mail, with sufficient postage, in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on October 10, 2000.

By: Linda McCormick
Name: Linda McCormick

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment, which is based on the Article 34.2 amendments, based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report, a copy of which is enclosed herewith:

IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page thereof.

IN THE SPECIFICATION

A courtesy copy of the present specification is enclosed herewith. However, the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

IN THE CLAIMS

In claim 4, line 2, delete "any one of claims 1 to 3" and insert--claim 1--

In claim 5, line 2, delete "any one of claims 1 to 4" and insert--claim 1--

In claim 8, line 2, delete "any one of claims 1 to 7" and insert--claim 1--

In claim 9, line 2, delete "any one of claims 1 to 8" and insert--claim 1--

In claim 11, line 2, delete "any one of claims 9 and 10" and insert--claim 9--

In claim 13, line 2, delete "any one of claims 11 and 13" and insert--claim 11--

In claim 18, line 2, delete "any one of claims 16 and 17" and insert--claim 16--

In claim 19, line 2, delete "any one of claims 16 to 18" and insert--claim 16--

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 4, 5, 8, 9, 11, 13, 18 and 19.

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, John J. Gresens (Reg. No. 33,112), at (612) 371.5265.

Respectfully submitted,

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Dated: October 10, 2000

By ______________________
John J. Gresens
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JJG/tvm

ABSTRACT

Title: CELLULAR RADIO SIGNAL WITH ADDITIONAL CHANNEL ASSIGNED TO DOWNLINK, CORRESPONDING METHOD, SYSTEM AND BASE STATION

The invention concerns a cellular radio telephone signal comprising a symmetrical two-way main channel, including a main uplink and a main downlink, in particular transmitting low or medium speed data and signaling and control data, and comprising at least one additional channel solely assigned to the downlink, transmitting in particular, high speed data transmission. At one given time, all or part of said supplementary channel transmission capacity can be dynamically allocated to a particular mobile station. Information for retrieving data intended for a particular mobile station and carried by said supplementary channel can be transmitted among said main downlink signaling and control data.

3/PRTS

Cellular radiotelephone signal with additional channel assigned to downlink, corresponding method, system, mobile and base station

The field of the invention is that of cellular radiotelephony. More exactly, the invention concerns data transmission, particularly at high speeds, in a radiotelephone system.

Known radiotelephone systems, such as the G.S.M. are essentially dedicated to voice communications. They implement two symmetrical links : a downlink (from a terrestrial base station to a mobile station) and an uplink (from the mobile station to the base station).

Systems under development are also based on such a structure. Thus, the standard UMTS defined by the ETSI provides for a symmetrical division between the downlink and the uplink.

The invention applies particularly to these systems. It can also be applied to satellite systems (GLOBALSTAR, ICO, IRIDIUM, etc.).

One of the problems to which radiotelephone systems will have to find a response in years to come, is the advent of new services and new applications, presupposing very high speed data transmission. Recent studies thus show that the resource allocated to data transfers (files, sounds, fixed or animated images), particularly via the Internet network, or similar networks, will represent a preponderant part of the resource available, from the year 2005 onwards, and higher, in the end, than the resource allocated to voice communications which should remain approximately constant.

A particular object of the invention is to bring a solution adapted to these new needs.

More exactly, an objective of the invention is to provide new cellular radiotelephone technology, allowing high speed data transmission, to radiotelephone mobile stations.

Another objective of the invention is to provide technology of this kind, which is compatible with known standards, and in particular the UMTS standard as defined by the ETSI.

Another objective of the invention is to provide technology of this kind, which optimises the use of the resource available, and which is based on a transmission method particularly adapted to high speed data transmission. Particularly, an objective of the invention is to offer an available speed of at least 6Mbits/s.

Another objective of the invention is to provide technology of this kind, which allows technically relatively simple and therefore inexpensive mobile stations to be made, which are adapted to receive different types of data (voice communications and high speed data particularly).

Another objective of the invention is to provide technology of this kind, allowing high speed data reception, even in unfavourable reception conditions (high displacement rate, of the order of at least 250km/h, and multiple paths particularly).

Still another objective of the invention is to provide technology of this kind, which allows an optimised and flexible allocation of the transmission resource, between one or more mobile stations, at a given moment. In particular, an objective of the invention is to allow the sharing of the high speed transmission resource between several operators.

These objectives, as well as others which will emerge subsequently, are met according to the invention

by means of a cellular radiotelephone signal, of the type including a main symmetrical bidirectional channel, including a main uplink and a main downlink, providing in particular low or medium speed transmission of signalling and control data and information, and also including at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

The invention therefore proposes an entirely new signal structure, in the context of radiotelephony, and more generally telephony systems. Indeed, all these systems are based on a symmetrical structure (based on the structure of voice communications). On the other hand, the technology of the invention is based on an entirely new, asymmetrical approach, which proves particularly adapted to new high speed applications.

In other words, the invention proposes the addition, to a conventional symmetrical channel, of a downlink only additional channel, dedicated to high speed data transmission, such as files transmitted on the Internet network.

It is appropriate to note that this solution is not obvious. It is based on a new analysis of radiotelephone systems, counter to the usual practices of the professional.

Although in what follows only one additional channel is considered, it is plain that several channels (corresponding for example to several frequency bands) are conceivable.

Preferentially, at a given moment, all or part of the transmission capacity of said additional channel is allocated dynamically to a particular mobile station.

Thus, the resource is allocated dynamically, only when required. It may be shared, frequentially and/or temporally, between several mobile stations. When

demand is not heavy, only one part of the resource (frequentially or temporally) is allocated.

To do this, information allowing the retrieval of data intended for a particular mobile station and carried by said additional channel is, to advantage, transmitted among said signalling and control information of said main downlink.

According to an advantageous characteristic of the invention, said main down channel and said additional channel have synchronous frame structures.

This allows synchronisation of the mobile station to be recovered from one of the channels (in particular the main channel) and for it to be applied directly to the other channel (in particular the additional channel). This is advantageous in particular when one of the channels implements a technique allowing a recovery of simple and precise synchronisation (the case of CDMA particularly).

According to an advantageous embodiment of the invention, said additional channel also provides the transmission of signalling and control information.

Particularly, said additional channel can provide at least the transmission of signalling and control information intended for the mobile station(s) in the method of transmitting data intended for said mobile station, on said additional channel.

For example, when said additional channel carries high speed data intended for said mobile station, said signalling and control information intended for a mobile station is duplicated or switched from said main downlink onto said additional channel.

Thus, the mobile may receive, at a given moment, only one or other of the channels. This allows the structure of the receiver to be considerably

simplified, by sharing at least a part of the reception means.

According to a particular embodiment of the invention, said main channel implements a spread spectrum access technology (CDMA). Particularly, the invention applies to the UMTS system.

Furthermore, to advantage, said additional channel implements a multi-carrier technology providing distribution of the data in the time/frequency space.

By multi-carrier technology is meant the implementation of a multiplex of carrier frequencies (for example according to OFDM technology).

In particular, said additional channel implements to advantage the "IOTA" modulation technology, the complex envelope of which responds to the following equation:

$$x(t) = \sum_{m,n} a_{m,n} i^{m+n} \Im(t - nT) e^{i\pi mt/T}$$

where:

.m is an integer representing the frequential dimension;

.n is an integer representing the temporal dimension;

.t represents time;

.T is the time symbol;

.$a_{m,n}$ is a real digital coefficient chosen from a pre-set alphabet;

.$\Im$ is the prototype IOTA function (as defined in FR-95 05455, corresponding to USSN 08/952,331.

To advantage, the transmission capacity of said additional channel is allocated to a given mobile station, dynamically, in the form of at least one "block" defined in the time/frequency space.

By "block" is meant in this instance a subset of the time/frequency space, defined by a given time

interval and a frequency band. More complex geometric structures than a "block" are of course conceivable (and possibly decomposable into a "sub-block").

Preferentially, said signalling and control information of said main downlink includes retrieval information of said blocks in the time/frequency space.

According to an embodiment of the invention, at least some of said blocks carry temporal and/or frequential synchronisation references.

This may particularly prove useful when high speed data is transmitted over a substantial period of time. These references may be used to maintain the previously acquired synchronisation.

The invention also concerns cellular radiotelephone systems and methodes implementing such a signal.

The invention further concerns the mobile stations of such a cellular radiotelephone system. This mobile station includes in particular reception means of at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

According to a preferential embodiment, such a mobile station includes single synchronisation means implementing an analysis of said main channel and delivering synchronisation information to methoding means of said main channel and to methoding means of said additional channel.

Thus, the realisation and implementation of the mobile station are simplified.

In an advantageous embodiment, the mobile station includes a single reception link including particularly transposition means onto an intermediate frequency of a received signal and demodulation means of the transposed signal, said received signal being able to

be selectively said main downlink or said additional channel.

To advantage, the mobile station also includes recovery means of said signalling and control information selectively on said main downlink or on said additional channel.

Thus, it is possible to share a part of the reception means between the two channels.

Lastly, the invention also concerns the base stations of such a cellular radiotelephone system, including particularly emission means of at least one additional channel solely assigned to the downlink, ensuring in particular high speed data transmission.

To advantage, such a base station includes transmission means of signalling and control information intended for a given mobile station on said additional channel, when the latter carries high speed data intended for said mobile station.

Other characteristics and advantages of the invention will emerge more clearly from reading the following description of a preferential embodiment, given as an illustrative and non-restrictive example, and the appended drawings, among which:

- Figure 1 evokes the allocation of frequency bands according to the UMTS standard and shows the way in which it can be adapted for the signal of the invention;
- Figure 2 shows an example of allocation of the high speed resource of the signal of Figure 1;
- Figure 3 shows a block diagram of a first embodiment of a mobile receiver according to the invention;
- Figure 4 shows a block diagram of a second embodiment of a mobile receiver according to the invention.

As already mentioned, market research on the UMTS has shown that data transmission would represent 80% of the total traffic by 2005, against 20% only for the voice. Data traffic would therefore be, as a consequence, to a very large extent, asymmetrical, with a heavy preponderance of the downlink (Internet).

The signal and the system of the invention meet this type of need.

In the embodiment described below, the invention is based on the UMTS standard defined by the ETSI. It therefore uses the following frequency bands, shown in Figure 1:

- 1900-1920MHz: TD-CDMA system in TDD (Time Division Duplex). This band is used for domestic applications ("cordless");
- 1920-1980MHz: WCDMA system ("Wideband Code Division Multiple Access"), uplink;
- 1980-2010MHz: mobile satellite system (ICO), uplink;
- 2010-2025MHz: high speed data transmission system, downlink, specific to the invention;
- 2110-2170MHz: WCDMA system ("Wideband Code Division Multiple Access"), downlink;
- 2170-2200MHz: mobile satellite system (ICO), downlink.

It may be noted therefore that the allocation of resources provided for by the ETSI is, conventionally, symmetrical. Indeed there is clearly:

- a downlink 11_1 and an uplink 11_2 each of 60MHz for exchanges according to W-CDMA technology;
- a downlink 12_1 and an uplink 12_2 each of 30MHz for exchanges by satellite (ICO);
- two TD-CDMA links 13_1 and 13_2, whose role was not yet defined and for which the invention proposes a particular implementation.

According to the invention, a combination of channels is used. To obtain an asymmetrical system, a low speed WCDMA (11_1 and 11_2) symmetrical channel and a high speed downlink transmission channel using a multi-carrier system 13_2 are combined.

The link 13_1 is for example assigned to domestic applications. For the downlink according to the invention preferentially the link 13_2 is selected which is frequentially separated from the W-CDMA link 11_2, which allows easy separation, by filtering, of the two links.

The link 13_2 may use a conventional multi-carrier modulation, such as that implemented in OFDM systems (see for example the DAB ("Digital Audio Broadcasting") standard for radio broadcasting). Below, the case is considered of an IOTA modulation, which proves particularly adapted to the invention. The principle and implementation of the IOTA modulation are described in patent application FR-95 05455, incorporated by reference.

To illustrate the principle of the invention, the example is considered of a user connecting to the Internet network.

When a channel is initially allocated to a user, only the WCDMA channel 11_1, 112 is really allocated. This channel is a low speed channel (for example 8 or 16 kbit/s) this channel is used conventionally on the uplink 112, so as to transmit signalling and data issuing from the user.

On the downlink 111, only signalling and low speed data are found as well as the high speed transmission channel 132 control information.

When the user loads a large file, the network allocates to this user an additional resource on the

IOTA channel 132. This allocation is carried out dynamically.

The WCDMA down channel 111 transmits control information allowing the additional resource allocated dynamically to the user concerned to be described.

This resource is described for example as the coordinates of a "block" of the time/frequency plane, in which the data will be transmitted. Below is given a form of definition of these "blocks" in the time/frequency plane in relation to Figure 2.

According to a first embodiment, the WCDMA down channel 111 is still active. In this case, the IOTA speed channel 132 is used exclusively to transmit data. The signalling is still transmitted via the WCDMA down channel 111.

A drawback of this first embodiment is that it presupposes the simultaneous reception of the WCDMA down channel 111 and of the IOTA channel 132.

A second embodiment overcoming this drawback consists in toggling the totality of the downlink information (signalling is given) onto the high speed IOTA channel 132 for the duration of the transmission of the allocated "block".

In this case, a part of the allocated resource is reserved for signalling. There is therefore a double "handover" (synchronous) from the signalling point of view: a first one to toggle the signalling onto the IOTA channel 132, as soon as the transmission of a block starts, and a second one to return automatically onto the WCDMA downlink channel 111, as soon as the transmission of the "block" is complete.

Downlink information can be switched onto the high speed channel or simply duplicated (which simplifies transitions during handovers).

This method is more complex to manage, from the signalling point of view, but, as will emerge subsequently, it simplifies the structure of the mobile receiver.

An embodiment of the signal of the invention is now described in more detail.

The system includes two types of physical channel: WCDMA channels and IOTA channels. To advantage, these two types of channels share a common frame structure.

For example, the totality of the signals may be described from a common 4.096 MHz clock. The transmission unit is the slot (time interval), of a duration of 625 ms. The elementary frame has a duration of 10 ms, that is 16 slots. A multi-frame of 720 ms is also defined.

The WCDMA channels use a chip rate of 4.096 MHz, that is 2560 chips (signal unit) per slot or 40960 chips per frame. The detailed specification can be found in the ETSI documentation (see particularly T doc SMG 905-97) and ARIB (Association of Radio Industries and Business) "specifications of air interface for a 3G mobile system" (18/12/97). The signal emitted comprises particularly all the references necessary for the temporal and frequential synchronisation of the mobile station.

The IOTA channel uses a time symbol T of 125 ms or of 62.5 ms, that is respectively 5 or 10 symbols per slot or again 512 or 256 chips per symbol. The spacing between carriers is 4 KHz in the first case and 8 KHz in the second case.

IOTA technology is described in detail in patent application FR-95 05455 already mentioned. In this document will be found all the information necessary for its implementation, for emission and reception.

The equation of the complex envelope of the transmitted signal is then:

$$x(t) = \sum_{m,n} a_{m,n} i^{m+n} \Im(t - nT) e^{i\pi mt/T}$$

where:

.m is an integer representing the frequential dimension;

.n is an integer representing the temporal dimension;

.t represents time;

.T is the time symbol;

.$a_{m,n}$ is a real digital coefficient chosen from a pre-set alphabet;

.$\Im$ is the prototype IOTA function (as defined in FR-95 05455).

According to the invention, a "block" is defined for example by relationships of framing the temporal index n and the frequential index m, as is shown in Figure 2. A block is allocated to a particular user.

For example, for a given communication, the network is to transmit a large file. It is allocated the block 21, which corresponds to the resource necessary to transmit the file. The location of this block is retrieved very simply by its two "ends" 251 (m1,n1) and 252 (m2,n2).

Of course, other retrieval methods of data intended for a user are conceivable.

It will be noted that the resource can easily be shared in time (no presupposition as to what precedes or follows the block 21), and in frequency. According to need, the frequency band can be shared, for example with the block 22. When there is no need, no transmission is carried out. Likewise, if only one part of the resource is required, a part of the frequency band 23 is able not be modulated.

A part of the data of the "block" can be reserved for the transmission of data transmitted the rest of the time on the main channel, as discussed below.

Two embodiments of a mobile receiver are now described.

In the first option, there is simultaneous reception of the two reception bands. The reception links 311 and 312 are simply duplicated.

The aerial 32 is connected to each of the reception links via a duplexer 33 having two outputs 341 and 342 corresponding to the bands 2110-2170 MHz or 2010-2025 MHz respectively, each output being connected to a reception link. This duplexer 33 also includes an input 35 covering the band 1920-1980 MHz. This input is connected to a power amplifier 36.

Each reception link 311, 312 includes:

- a low noise amplifier (LNA) 371 and 372;
- a mixer 381,382 and a synthesizer 391,392 allowing one of the two previous bands to be transposed into intermediate frequency;
- an IF filter 3101,3102 of a bandwidth of the order of 5MHz;
- an IQ baseband converter 3111, 3112, controlled by a synthesizer 3121,3122;
- an analogue-to-digital converter (ADC) 3131,I,3131,Q and 3132,I,3132,Q on each of the I and Q links with a sampling frequency of 8.192 MHz.

Digital methoding (demodulation, decoding) is carried out by a signal methodor (DSP) 314 combined with two "hardware" accelerators:

- a correlator for the realisation of the rake filter required for CDMA signal demodulation (3141);

- an FFT comethodor for demodulation of IOTA signals(3142).

The DSP, combined with a "hardware" accelerator for modulation, also generates WCDMA signals to be emitted in the form of digital I and Q samples (3143).

The emission link includes:

- a digital-to-analogue converter 315I,315Q on each of the I and Q links with a sampling frequency of 8.192 MHz;;
- an IF modulator 316 controlled by a synthesizer 317;
- a mixer 318 and a dynamic sythesizer 319 allowing signals to be transposed into intermediate frequency in the emission band;
- a power amplifier 36.

The synchronisation of the mobile station for reception of WCDMA signals uses conventional techniques in this domain, and particularly the Rake filter for temporal synchronisation.

Once the reference oscillator and the mobile time base have been compelled, this synchronisation is used directly for the reception of IOTA signals, for which no additional synchronisation method is required.

Thus there is a direct benefit derived from the quality and facility of synchronisation of CDMA technology when high speed data is received, without adaptation (the frame structures being the same).

In the second option, there is no simultaneous reception of the two reception bands. This markedly simplifies the structure of the receiver. The duplexer 33 and the emission link are identical to the first option. They are therefore not subject to further comment.

The receiver includes:

- a low noise amplifier (LNA) 371 connected to the 2170-2200 MHz output of the duplexer;
- a low noise amplifier (LNA) 372 connected to the 2010-2025 MHz output of the duplexer;
- a switch 41 allowing the two LNA outputs to be switched;
- a mixer 42 and a double band synthesizer 43 allowing the two previous bands to be transposed into intermediate frequency;
- an IF bandpass filter 44 of a bandwidth of the order of 5 MHz;
- an IQ baseband converter 45 controlled by a synthesizer 46;
- an analogue-to-digital converter 47I,47Q on each of the I and Q bands, with a sampling frequency of 8.192 MHz.

Reception digital methoding 314 is identical to that of the first option. On the other hand, there is no simultaneous methoding of WCDMA signals and of IOTA signals, which reduces the CPU load of the DSP methodor 314.

The synchronisation of the mobile station for the reception of WCDMA signals is identical to that described previously. Once the reference oscillator and the mobile station time base are compelled, this initial synchronisation is used directly for the reception of IOTA signals, for which no additional synchronisation method is required.

However, the reception of WCDMA signals being then interrupted, the maintenance of this synchronisation must however be provided by other means. Nonetheless, as a general rule, the transmission of a block is relatively short, and it is not necessary to re-synchronise the mobile station, the inherent stability of the reference oscillator being more than adequate

for a few seconds. However, if the allocation is of long duration, it might then be necessary to insert periodically additional temporal and frequential synchronisation references.

CLAIMS

1. A cellular radiotelephone signal, of the type including a main symmetrical bidirectional channel, including a main uplink and a main downlink, providing in particular low or medium speed transmission of signalling and control data and information,
characterised in that it includes at least one additional channel solely assigned to downlink, providing in particular high speed data transmission.

2. A cellular radiotelephone signal according to claim 1, characterised in that, at a given moment, all or part of the transmission capacity of said additional channel is allocated dynamically to a particular mobile station.

3. A cellular radiotelephone signal according to claim 2, characterised in that information allowing the retrieval of data intended for a particular mobile station and carried by said additional channel is transmitted among said signalling and control information of said main downlink.

4. A cellular radiotelephone signal according to any one of claims 1 to 3, characterised in that said main channel and said additional channel have synchronous frame structures.

5. A cellular radiotelephone signal according to any one of claims 1 to 4, characterised in that said additional channel also provides for transmission of signalling and control information.

6. A cellular radiotelephone signal according to claim 5, characterised in that said additional channel provides at least for transmission of signalling and control information intended for mobile station(s) in the method of transmitting data intended for said mobile station, on said additional channel.

7. A cellular radiotelephone signal according to claim 6, characterised in that, when said additional channel carries high speed data intended for said mobile station, said signalling and control information intended for a mobile station is duplicated or switched from said main downlink onto said additional channel.

8. A cellular radiotelephone signal according to any one of claims 1 to 7, characterised in that said main channel implements a spread spectrum access technology (CDMA).

9 A cellular radiotelephone signal according to any one of claims 1 to 8, characterised in that said additional channel implements a multi-carrier technology providing distribution of data in the time/frequency space.

10. A cellular radiotelephone signal according to claim 9, characterised in that said additional channel has a complex envelope responding to the following equation:

$$x(t) = \sum_{m,n} a_{m,n} i^{m+n} \Im(t - nT) e^{i\pi mt/T}$$

where:

.m is an integer representing the frequential dimension;

.n is an integer representing the temporal dimension;

.t represents time;

.T is the time symbol;

.$a_{m,n}$ is a real digital coefficient chosen from a pre-set alphabet;

.$\Im$ is the prototype IOTA function (as defined in FR-95 05455).

11. A cellular radiotelephone signal according to any one of claims 9 and 10, characterised in that the transmission capacity of said additional channel is allocated to a given mobile station, dynamically, in

the form of at least one block defined in the time/frequency space.

12. A cellular radiotelephone signal according to claim 11, characterised in that said signalling and control information of said main downlink includes retrieval information of said blocks in the time/frequency space.

13. A cellular radiotelephone signal according to any one of claims 11 and 13, characterised in that at least some of said blocks carry temporal and/or frequential synchronisation references.

14. A cellular radiotelephone system of the type implementing a main symmetrical bidirectional channel, including a main uplink and a main downlink, providing in particular low or medium speed transmission of signalling and control data and information,
characterised in that it also implements at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

15. A cellular radiotelephone method of the type implementing a main symmetrical bidirectional channel, including a main uplink and a main downlink, providing in particular low or medium speed transmission of signalling and control data and information,
characterised in that it also implements at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

16. A mobile station of a cellular radiotelephone system, including emission means of main uplink and reception means of a main downlink, said uplinks and downlinks forming a main symmetrical bidirectional channel providing in particular low or medium speed transmission of signalling and control data and information,

characterised in that it also includes reception means of at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

17. A mobile station of a cellular radiotelephone system according to claim 16, characterised in that it includes single synchronisation means implementing an analysis of said main channel and delivering synchronisation information to methoding means of said main channel and to methoding means of said additional channel.

18. A mobile station of a cellular radiotelephone system according to any one of claims 16 and 17, characterised in that it includes a single reception link including particularly transposition means onto an intermediate frequency of a received signal and demodulation means of the transposed signal, said received signal being able to be selectively said main downlink or said additional channel.

19. A mobile station of a cellular radiotelephone system according to any one of claims 16 to 18, characterised in that it includes recovery means of said signalling and control information selectively on said main downlink or on said additional channel.

20. A base station of a cellular radiotelephone system, of the type including reception means of a main uplink and emission means of a main downlink, said uplinks and downlinks forming a main symmetrical bidirectional channel providing in particular low or medium speed transmission of signalling and control data and information,
characterised in that it also includes emission means of at least one additional channel solely assigned to the downlink, providing in particular high speed data transmission.

21. A base station of a cellular radiotelephone system according to claim 20, characterised in that it includes transmission means of signalling and control information intended for a given mobile station on said additional channel, when the latter carries high speed data intended for said mobile station.

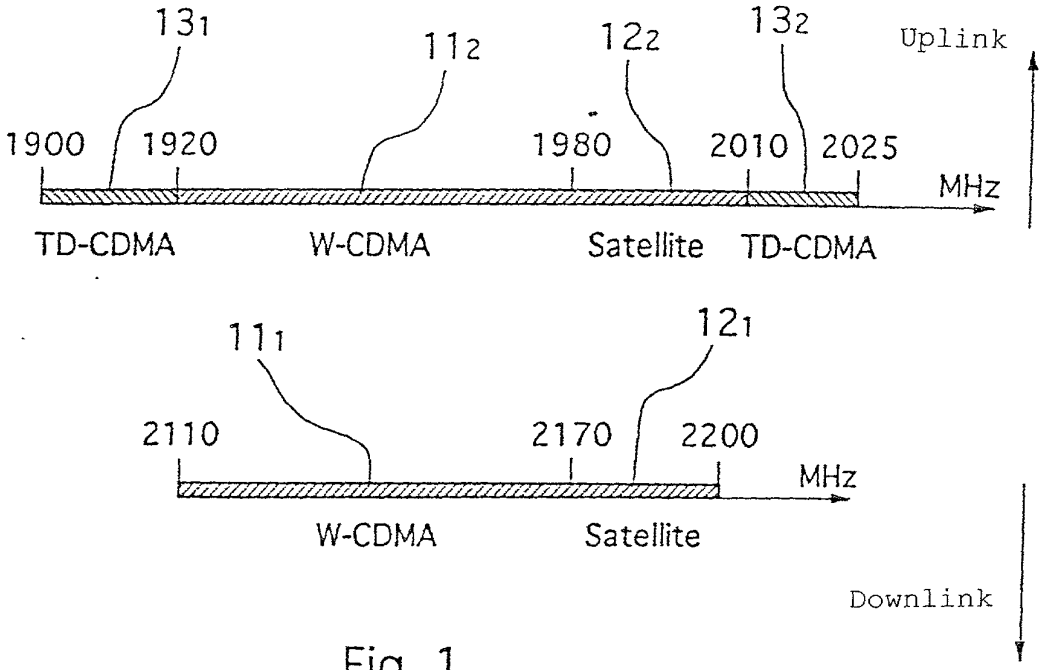
131
112
122
132
Uplink
1900
1920
1980
2010
2025
MHz
TD-CDMA
W-CDMA
Satellite
TD-CDMA
111
121
2110
2170
2200
MHz
W-CDMA
Satellite
Downlink

Fig. 1

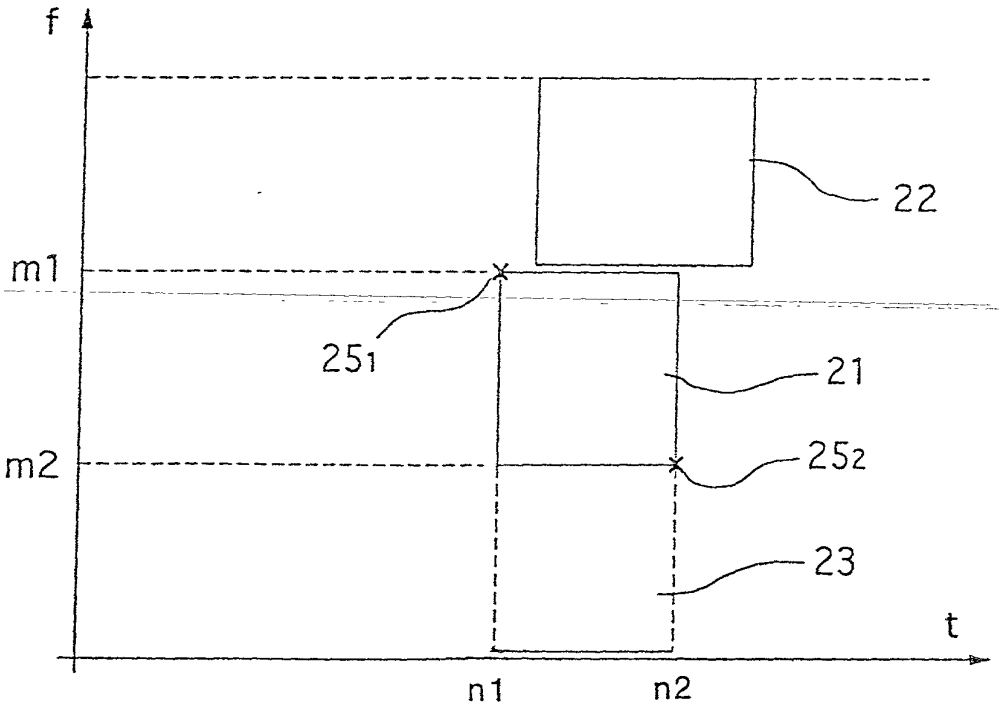
f
22
m1
251
21
m2
252
23
t
n1
n2

Fig. 2

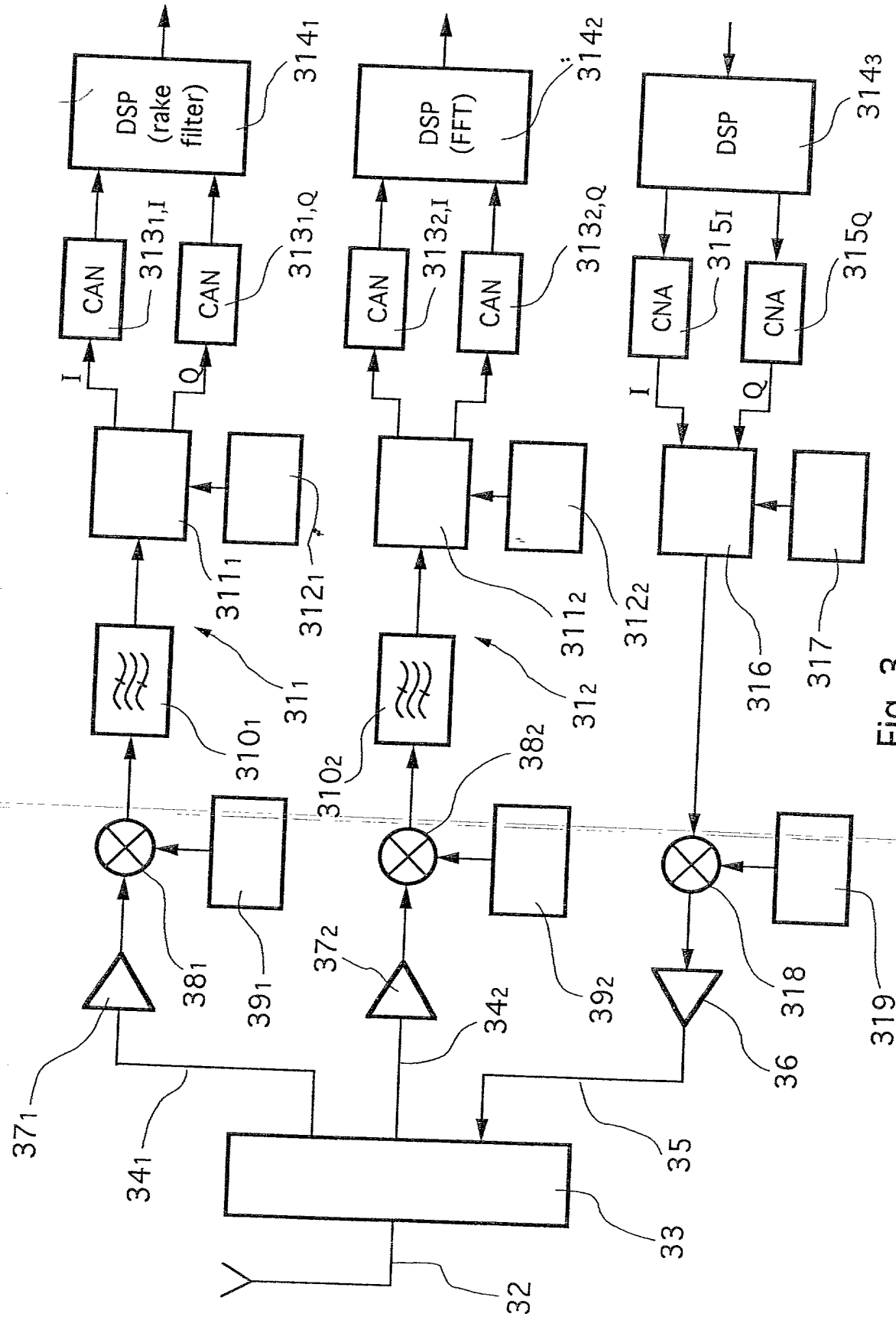
DSP (rake filter)
DSP (FFT)
DSP
CAN
CNA
I
Q
Y
32
33
35
36
316
317
318
319

Fig. 3

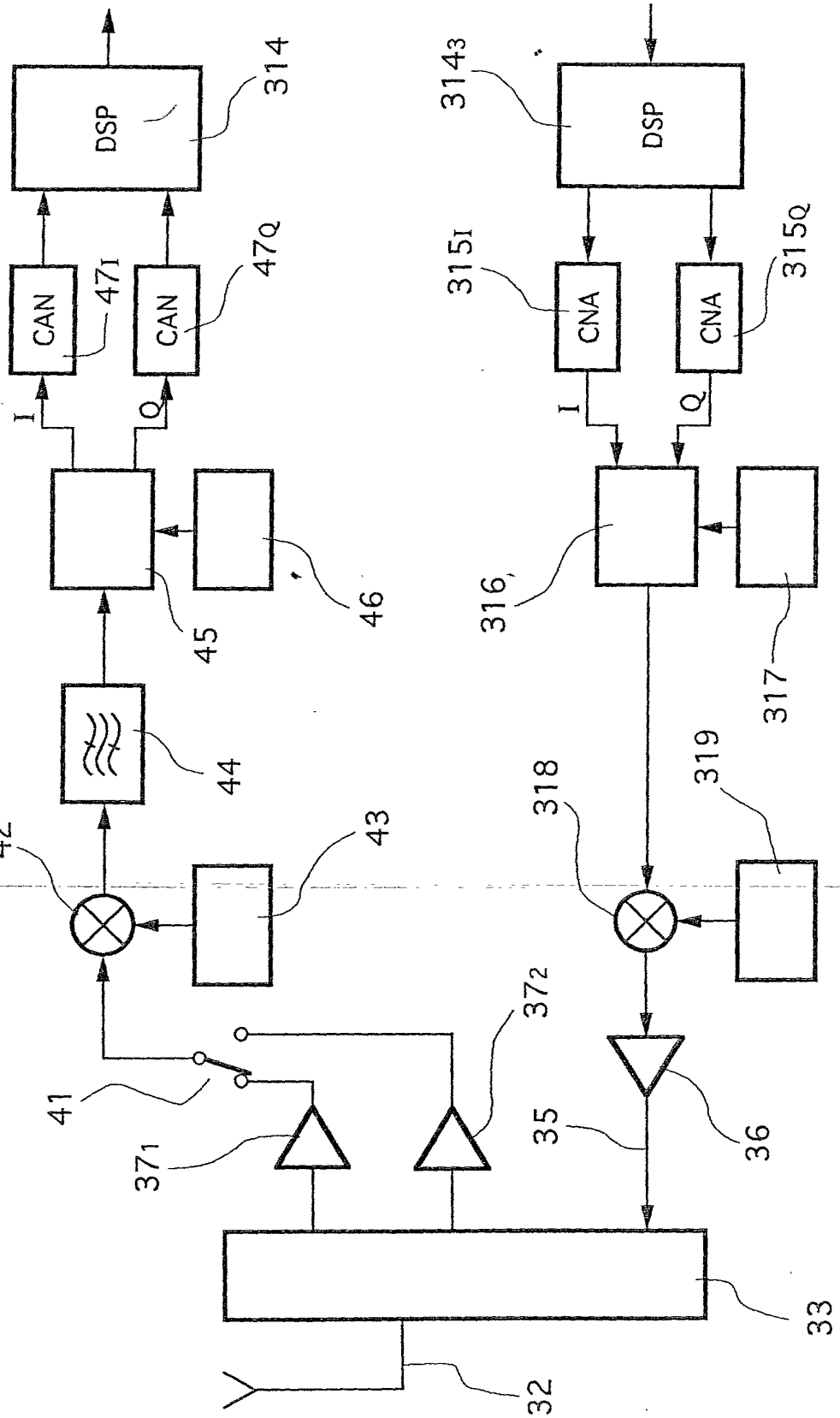
DSP
314
CAN
47I
CAN
47Q
I
Q
45
46
44
42
43
41
37I
37Q
32
33
35
36
DSP
3143
CNA
315I
CNA
315Q
I
Q
316
317
318
319

Fig. 4

Attorney Docket No. 9320.112USWO

MERCHANT & GOULD P.C.

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: CELLULAR RADIO SIGNAL WITH ADDITIONAL CHANNEL ASSIGNED TO DOWNLINK, CORRESPONDING METHOD, SYSTEM AND BASE STATION

The specification of which
a. ☐ is attached hereto
b. ☒ was filed on as application serial no. and was amended on (if applicable) (in the case of a PCT-filed application) described and claimed in international no. PCT/FR99/00849 filed April 12, 1999 and as amended on (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (attached hereto).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

a. ☐ no such applications have been filed.
b. ☒ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	**APPLICATION NUMBER**	**DATE OF FILING (day, month, year)**	**DATE OF ISSUE (day, month, year)**
France	98 04883	4 April 1998	
ALL FOREIGN APPLICATION(S), IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	**APPLICATION NUMBER**	**DATE OF FILING (day, month, year)**	**DATE OF ISSUE (day, month, year)**

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Albrecht, John W.	Reg. No. 40,481	Leon, Andrew J.	Reg. No. P-46,869
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Batzli, Brian H.	Reg. No. 32,960	Lindquist, Timothy A.	Reg. No. 40,701
Beard, John L.	Reg. No. 27,612	Lycke, Lawrence E.	Reg. No. 38,540
Berns, John M.	Reg. No. 43,496	McAuley, Steven A.	Reg. No. 46,084
Black, Bruce E.	Reg. No. 41,622	McDonald, Daniel W.	Reg. No. 32,044
Branch, John W.	Reg. No. 41,633	McIntyre, Jr., William F.	Reg. No. 44,921
Bremer, Dennis C.	Reg. No. 40,528	Mitchem, M. Todd	Reg. No. 40,731
Bruess, Steven C.	Reg. No. 34,130	Mueller, Douglas P.	Reg. No. 30,300
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Caspers, Philip P.	Reg. No. 33,227	Phillips, John B.	Reg. No. 37,206
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Daley, Dennis R.	Reg. No. 34,994	Qualey, Terry	Reg. No. 25,148
Dalglish, Leslie E.	Reg. No. 40,579	Reich, John C.	Reg. No. 37,703
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DeVries Smith, Katherine M.	Reg. No. 42,157	Samuels, Lisa A.	Reg. No. 43,080
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Epp Ryan, Sandra	Reg. No. 39,667	Schumann, Michael D.	Reg. No. 30,422
Glance, Robert J.	Reg. No. 40,620	Scull, Timothy B.	Reg. No. 42,137
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Gorman, Alan G.	Reg. No. 38,472	Spellman, Steven J.	Reg. No. 45,124
Gould, John D.	Reg. No. 18,223	Stoll-DeBell, Kirstin L.	Reg. No. 43,164
Gregson, Richard	Reg. No. 41,804	Sumner, John P.	Reg. No. 29,114
Gresens, John J.	Reg. No. 33,112	Swenson, Erik G.	Reg. No. 45,147
Hamer, Samuel A.	Reg. No. P-46,754	Tellekson, David K.	Reg. No. 32,314
Hamre, Curtis B.	Reg. No. 29,165	Trembath, Jon R.	Reg. No. 38,344
Harrison, Kevin C.	Reg. No.P-46,759	Tuchman, Ido	Reg. No. 45,924
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Holzer, Jr., Richard J.	Reg. No. 42,668	Wahl, John R.	Reg. No. 33,044
Johnston, Scott W.	Reg. No. 39,721	Weaver, Karrie G.	Reg. No. 43,245
Kadievitch, Natalie D.	Reg. No. 34,196	Welter, Paul A.	Reg. No. 20,890
Karjeker, Shaukat	Reg. No. 34,049	Whipps, Brian	Reg. No. 43,261
Kastelic, Joseph M.	Reg. No. 37,160	Whitaker, John E.	Reg. No. 42,222
Kettelberger, Denise	Reg. No. 33,924	Wickhem, J. Scot	Reg. No. 41,376
Keys, Jeramie J.	Reg. No. 42,724	Williams, Douglas J.	Reg. No. 27,054
Knearl, Homer L.	Reg. No. 21,197	Withers, James D.	Reg. No. 40,376
Kowalchyk, Alan W.	Reg. No. 31,535	Witt, Jonelle	Reg. No. 41,980
Kowalchyk, Katherine M.	Reg. No. 36,848	Wu, Tong	Reg. No. 43,361
Lacy, Paul E.	Reg. No. 38,946	Xu, Min S.	Reg. No. 39,536
Larson, James A.	Reg. No. 40,443	Zeuli, Anthony R.	Reg. No. 45,255

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

Merchant & Gould P.C.
P.O. Box 2903
Minneapolis, MN 55402-0903

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2	**Full Name Of Inventor**	**Family Name** Alard	**First Given Name** Michel	**Second Given Name**
0	**Residence & Citizenship**	**City** Paris	**State or Foreign Country** France	**Country of Citizenship** France
1	**Post Office Address**	**Post Office Address** 32, rue des Francs bourgeois	**City** Paris	**State & Zip Code/Country** 75004 / France
Signature of Inventor 201:			**Date:**	

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application:

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.